DrJ CERTIFICATION

Technical Evaluation Report™

A Duly Authenticated Report from an Approved Agency

Report Number 1808-04

OX-IS® and SI-Strong Structural Insulation Limit States Design - Canada

OX Engineered Products, LLC

Product:
OX-IS and SI-Strong Structural Insulation

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES	**DIVISION**: 07 00 00 - THERMAL AND MOISTURE PROTECTION
Section: 06 12 00 - Structural Panels	Section: 07 21 00 - Thermal Insulation
Section: 06 12 19 - Shear Wall Panels	Section: 07 25 00 - Water-Resistive Barriers/Weather Barriers
Section: 06 16 00 - Sheathing	Section: 07 27 00 - Air Barriers

1 Innovative Products Evaluated[1]

1.1 OX-IS and SI-Strong Structural Insulation

2 Applicable Codes and Standards[2]

2.1 *Codes*

2.1.1 *NBC—10, 15, 20: National Building Code of Canada*

2.1.2 *NECB—17, 20: National Energy Code of Canada for Buildings*

2.2 *Standards and Referenced Documents*

2.2.1 *ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*

2.2.2 *ASTM C557: Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing*

2.2.3 *ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*

2.2.4 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference*

2.2.5 *ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*

2.2.6 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

2.2.7 *ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*

2.2.8 *ASTM E2178: Standard Test Method for Air Permeance of Building Materials*

2.2.9 *CAN/ULC-S102: Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies*

2.2.10 *CSA O86: Engineering Design in Wood*

2.2.11 *CWC: Engineering Guide for Wood Frame Construction*

3 Performance Evaluation

3.1 Testing and related engineering evaluations are defined as intellectual property and/or trade secrets.[3]

3.2 Engineering evaluations are conducted within DrJ's ANAB accredited ICS code scope, which are also its areas of professional engineering competence.[4]

3.3 OX-IS and SI-Strong Structural Insulation were evaluated to determine:

3.3.1 Structural performance under lateral load conditions for both wind and seismic loading in accordance with NBC Division B Subsection 9.23.13 and Subsection 4.1.8.

3.3.2 Structural performance under lateral load conditions for both wind and seismic loading in accordance with NBC Division B Part 4 Structural Loads and Procedures and the CWC Engineering Guide for Wood Frame Construction.

3.3.2.1 **Table 2** provides Seismic Design Coefficients (SDC) that conform to the requirements in NBC Division B Subsection 4.1.8 for design of wall assemblies in buildings that require seismic design in accordance with NBC (i.e., all seismic design categories).

3.3.2.2 The basis for equivalency testing is outlined in Sentence 4.1.8.9.(5) of NBC, Division B:

> If it can be demonstrated through testing, research and analysis that the seismic performance of a structural system is at least equivalent to one of the types of SFRS mentioned in Table 4.1.8.9., then such structural system will qualify for values of Rd and Ro corresponding to the equivalent type in that Table. (See Note A-4.1.8.9.(5).).

3.3.3 Resistance to uplift loads for wall assemblies used for light-frame wood construction in accordance with NBC Division B Article 9.23.3.4.

3.3.4 Resistance to transverse loads for wall assemblies used in light-frame wood construction in accordance with NBC Division B Subsection 4.1.7.

3.3.5 Performance for use as foamed plastic insulation in accordance with the NBC Division B Article 3.1.5.15.

3.3.6 Performance for use as thermal insulation in accordance with NBC Division B Article 9.36.2.5 and NECB Division B Article 3.2.1.2.

3.3.7 Performance for use as an air barrier material in accordance with NBC Division B Article 9.36.2.10.

3.3.8 Performance for use as a Water-Resistive Barrier (WRB) in accordance with NBC Division B Note A-5.6.2.1.

3.3.9 Performance for surface burning characteristics in accordance with NBC Division B Subsection 3.1.12 and Article 9.10.3.2.

3.4 Any regulation specific issues not addressed in this section are outside the scope of this report.

4 Product Description and Materials

4.1 The innovative products evaluated in this report are shown in **Figure 1**, **Figure 2** and **Figure 3**.

Figure 1. OX-IS Logo

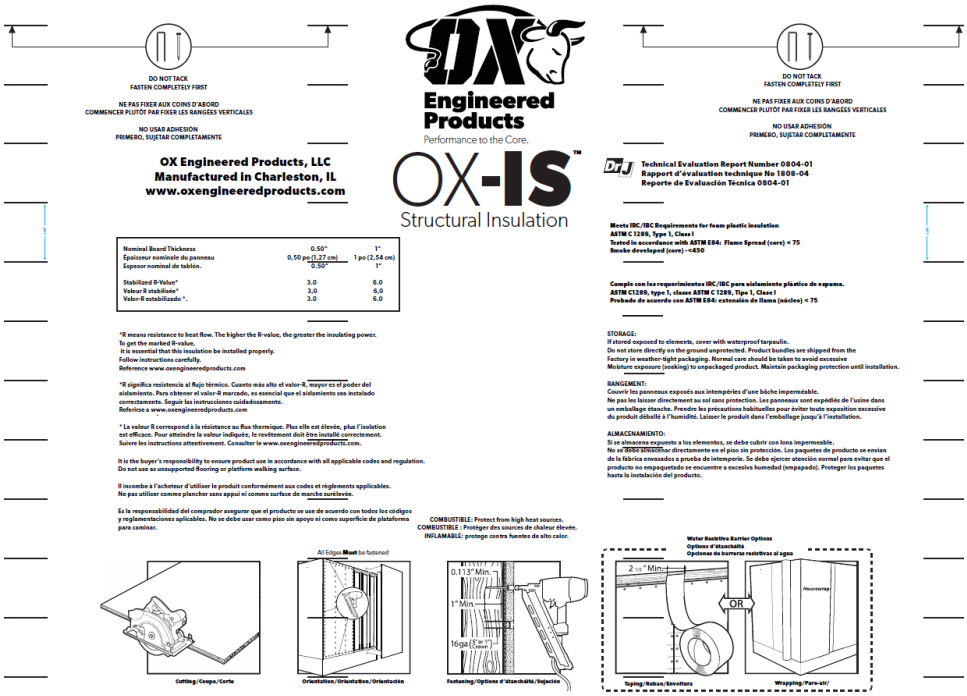


Figure 2. OX-IS Structural Insulation Product Label

Figure 3. SI-Strong Structural Insulation Product Label

4.2 OX-IS and SI-Strong Structural Insulation are structural rigid insulation sheathing products consisting of a proprietary fibrous sheathing board laminated to one side of a proprietary rigid foamed plastic insulation.

4.2.1 The proprietary fibrous sheathing is made of specially treated plies that are pressure-laminated with a water-resistant adhesive. The surface finish consists of a facer on one or both sides, using either a 2.9 mm (0.113") nominal thickness or a 3.4 mm (0.135") nominal thickness fibrous sheathing board.

4.2.2 The rigid foamed plastic insulation is a proprietary polyisocyanurate (polyiso), which can have facings on one or both sides.

4.3 *Material Availability*

4.3.1 *Thickness:*

4.3.1.1 12.7 mm ($^1/_2$")

4.3.1.2 19.1 mm ($^3/_4$")

4.3.1.3 25.4 mm (1")

4.3.1.4 38.1 mm (1 $^1/_2$")

4.3.2 *Standard Product Width:*

4.3.2.1 1219 mm (48")

4.3.3 *Standard Lengths:*

4.3.3.1 2438 mm (96")

4.3.3.2 2749 mm (108")

4.3.3.3 3048 mm (120")

5 Applications

5.1 *General*

5.1.1 OX-IS and SI-Strong Structural Insulation are Structural Insulated Sheathing (SIS) panels for use in the following applications:

5.1.1.1 Wall sheathing in buildings constructed in accordance with the NBC for light-frame wood and steel construction.

5.1.1.2 Structural wall sheathing to provide lateral load resistance (wind and seismic) for braced wall panels used in light-frame construction.

5.1.1.3 Structural wall sheathing to provide resistance to transverse loads for wall assemblies used in wood construction.

5.1.1.4 Insulating sheathing applied as in-fill to portions of walls that are not designed as braced wall panels or shear walls.

5.1.1.5 Insulated sheathing in accordance with the NBC Division B Article 9.36.2.5 and NECB Division B Article 3.2.1.2.

5.1.1.6 An approved WRB in accordance with NBC Division B Note A-5.6.2.1, when installed with approved Construction Tape on all sheathing seams, as in **Section 5.3.3**. See the manufacturer product information for further details.

5.1.1.6.1 Where the joints are not taped, a separate WRB shall be installed in accordance with the WRB manufacturer installation instructions.

5.1.1.7 An air-barrier material as part of an air-barrier assembly in accordance with NBC Division B Section 5.4 and Subsection 9.25.3 and NECB Division B Subsection 3.2.4, in accordance with the manufacturer installation instructions and this report.

5.1.2 OX-IS and SI-Strong Structural Insulation contain foamed plastics complying with NBC Division B Article 3.1.5.15.

5.2 *Structural Applications*

5.2.1 *General Provisions:*

5.2.1.1 Except as otherwise described in this report, OX-IS and SI-Strong Structural Insulation shall be installed in accordance with the applicable building codes listed in **Section 2**, using the provisions set forth herein for the design and installation of Wood Structural Panels (WSP).

5.2.1.1.1 OX-IS and SI-Strong Structural Insulation shall be permitted to be designed in accordance with NBC Division B Part 9 Articles 9.23.13.1, 9.23.13.2, and 9.23.13.3 for the design of lateral-load resisting systems using the methods and conditions set forth therein.

5.2.1.2 Anchorage for in-plane shear shall be provided to transfer the induced shear force into and out of each shear wall.

5.2.1.2.1 For wind design, anchor-bolt spacing shall not exceed 1.8 m (6') o.c.

5.2.1.3 The maximum aspect ratio for OX-IS and SI-Strong Structural Insulation shall be 4:1.

5.2.1.4 The minimum full-height panel width shall be 610 mm (24").

5.2.1.5 All panel edges shall be blocked with lumber of a minimum thickness of 38 mm (2" nominal).

5.2.1.6 Fasteners may be countersunk beneath the outer surface of the foamed plastic sheathing layer.

5.2.1.7 Installation is permitted for single-top-plate (advanced framing method) or double-top-plate applications.

5.2.2 *Performance-Based Wood-Frame Construction:*

5.2.2.1 OX-IS and SI-Strong Structural Insulation panels used in wall assemblies designed as shear walls:

5.2.2.1.1 Are permitted to be designed in accordance with the methodology used in CAN/CSA-O86 for WSP using the capacities shown in **Table 1**.

5.2.2.1.2 Resist lateral wind load forces using the specified shear strengths set forth in **Table 1**.

5.2.2.1.3 Resist uplift load forces using the specified uplift loads in **Table 3**.

5.2.2.1.4 Resist seismic load forces using the seismic specified shear strengths set forth in **Table 2** when seismic design is required in accordance with NBC Division B Subsection 4.1.8.

5.2.2.1.4.1 The ductility response modification factor, R_d, and the over-strength force modification factor, R_o, indicated in **Table 2** shall be used to determine the base shear, element design forces, and design story drift in accordance with NBC Division B Subsection 4.1.8.

5.2.2.2 OX-IS and SI-Strong Structural Insulation panels are permitted to resist transverse wind load forces using the specified transverse resistances set forth in **Table 4**. Required component-and-cladding loads to be resisted are found in NBC Division B Subsection 4.1.7 (Sentence 4.1.7.1.(5)).

Table 1. Specified Shear Resistance for Limit States Design for OX-IS and SI-Strong Structural Insulation – Wind[4]

Structural Sheathing Product	Sheathing Thickness mm (in)	Fastener Spacing (edge/field) mm (in)	Maximum Stud Spacing mm (in)	Gypsum Wallboard (GWB)[2,6] mm (in)	Gypsum Wallboard Fastener Spacing (edge/field) mm (in)	Specified Shear Strength kN/m (plf)
OX-IS and SI-Strong Structural Insulation	12.7 (1/2)	76/76 (3/3)[1]	406 (16 o.c.)	12.7 (1/2) GWB	203/203 (8/8)	8.5 (580)
					406/406 (16/16)	7.1 (490)
		76/152 (3/6)	406 (16 o.c.)	12.7 (1/2) GWB	406/406 (16/16)	6.9 (470)(1)
					203/203 (8/8)	8.2 (560)(1)
						6.7 (460)(3)
		76/76 (3/3)[1]	610 (24) o.c.	12.7 (1/2) GWB	203/203 (8/8)	7.4 (505)
		76/152 (3/6)[1]			203/305 (8/12)	13.5 (925)
		76/76 (3/3)[1]	406 (16) o.c.	No GWB	-	5.8 (395)
			610 (24) o.c.			5.3 (365)
	19.1 (3/4)	76/76 (3/3)[6]	406 (16) o.c.	No GWB	-	5.3 (365)
			610 (24) o.c.			4.8 (325)
		76/76 (3/3)[1]	406 (16) o.c.			6.9 (475)
			610 (24) o.c.			6.2 (425)
	23.4 (0.92) and 25.4 (1)	76/76 (3/3)[1]	406 (16) o.c.	No GWB	-	6.3 (430)
			610 (24) o.c.			5.7 (390)
			610 (24) o.c.	12.7 (1/2) GWB and Thermo-Ply® Red[5]	203/203 (8/8)	10.6 (725)
			406 (16) o.c.	12.7 (1/2) GWB	203/203 (8/8)	9.1 (625)
					406/406 (16/16)	7.7 (530)
			610 (24) o.c.		203/203 (8/8)	8.7 (595)
					406/406 (16/16)	7.3 (500)
	38.1 (1 1/2)	76/76 (3/3)[1]	406 (16) o.c.	No GWB	-	5.9 (405)
			610 (24) o.c.			5.3 (365)
		76/152 (3/6)[6]	406 (16) o.c.	12.7 (1/2) GWB	203/203 (8/8)	8.0 (550)
			610 (24) o.c.			7.1 (490)

Table 1. Specified Shear Resistance for Limit States Design for OX-IS and SI-Strong Structural Insulation – Wind[4]

Structural Sheathing Product	Sheathing Thickness mm (in)	Fastener Spacing (edge/field) mm (in)	Maximum Stud Spacing mm (in)	Gypsum Wallboard (GWB)[2,6] mm (in)	Gypsum Wallboard Fastener Spacing (edge/field) mm (in)	Specified Shear Strength kN/m (plf)

SI: 25.4 mm = 1 in, 1 kN/m = 737.6 lb/ft

1. OX-IS and SI-Strong Structural Insulation attached with a minimum 16-gauge, 25 mm (1") crown staples shall penetrate a minimum of 25 mm (1") into the stud. Fasteners are to be installed with the crown parallel to the framing and spaced a maximum of 76 mm (3") o.c. at the panel edges and 76 mm (3") o.c. in the field. Fastener edge distance shall be a minimum of 9.5 mm (3/8"). Fastener head shall be in contact with the panel surface. Alternatively, fastener heads are permitted to be overdriven into foam portion of the panel with no reduction in shear capacities.
2. Gypsum attached with minimum #6 type W or S screws 32 mm (1 1/4") long with a minimum edge distance of 9.5 mm (3/8").
3. SIS fastened with a minimum 2.9 mm (0.113") diameter nail.
4. 12.7 mm (1/2") GWB adhered with wall-and-floor adhesive (ASTM C557) and #6 (152 mm x 32 mm [6" x 1 1/4"]) bugle-head, coarse-thread drywall screws, edges blocked.
5. Install Thermo-Ply Red on opposite side of wall from the SIS with minimum 16-gauge, 25 mm (1") crown staples fastened 76 mm (3") o.c edge/ 76 mm (3") o.c. field. Separately attach 12.7 mm (1/2") gypsum over Thermo-Ply Red with minimum #6 type W or S screws 32 mm (1 1/4") long fastened 203 mm (8") o.c edge/203 mm (8") o.c. field.
6. OX-IS and SI-Strong Structural Insulation attached with a minimum 60 mm x 2.9 mm (2 3/8" x 0.113) nails shall penetrate a minimum of 25 mm (1") into the stud. Fasteners are to be spaced a maximum of 76 mm (3") o.c. at the panel edges and 76 mm (3") o.c. in the field. Fastener edge distance shall be a minimum of 9.5 mm (3/8"). Fastener head shall be in contact with the panel surface. Alternatively, fastener heads are permitted to be overdriven into foam portion of the panel with no reduction in shear capacities.

Table 2. Specified Shear Resistance for Limit States Design and Seismic Design Coefficients for OX-IS and SI-Strong Structural Insulation[1,3,6,7]

Seismic Force Resisting System (SFRS)	Thickness mm (in)	Gypsum[2,9] Wallboard Fastening Schedule mm (in)	Maximum Stud Spacing mm (in)	Specified Shear Strength, kN/m (plf)	Ductility Factor, R_d[4,5]	Overstrength Force Modification Factor, R_0[5]	Structural System Limitations and Building Height Limit,[8] m (ft)				
							$I_E F_a S_a$ (0.2)				$I_E F_a S_a$ (1.0)
							SC1	SC2	SC3	SC4	SC4
							< 0.2	≥ 0.2 to < 0.35	≥ 0.35 to ≤ 0.75	> 0.75	> 0.3
Light-Frame (Wood) Walls Sheathed with OX-IS and SI-Strong Structural Insulation	12.7 (1/2)	406/406 (16/16)	406 (16) o.c.	7.1 (490)	2.0	1.7	NL	NL	20 (65.6)	20 (65.6)	20 (65.6)
		203/203 (8/8)		8.5 (580)							
	19.1 (1/2)	No GWB	406 (16) o.c.	6.9 (475)	2.0	1.7	NL	NL	20 (65.6)	20 (65.6)	20 (65.6)
			610 (24) o.c.	6.2 (425)							
	25.4 (1)	406/406 (16/16)	406 (16) o.c.	7.7 (530)	2.0	1.7	NL	NL	20 (65.6)	20 (65.6)	20 (65.6)
		203/203 (8/8)		9.1 (625)							
		406/406 (16/16)	610 (24) o.c.	7.3 (500)							
		203/203 (8/8)		8.7 (595)							

Table 2. Specified Shear Resistance for Limit States Design and Seismic Design Coefficients for OX-IS and SI-Strong Structural Insulation[1,3,6,7]

Seismic Force Resisting System (SFRS)	Thickness mm (in)	Gypsum[2,9] Wallboard Fastening Schedule mm (in)	Maximum Stud Spacing mm (in)	Specified Shear Strength, kN/m (plf)	Ductility Factor, R_d[4,5]	Overstrength Force Modification Factor, R_0[5]	Structural System Limitations and Building Height Limit,[8] m (ft)				
							$I_E F_a S_a$ (0.2)				$I_E F_a S_a$ (1.0)
							SC1	SC2	SC3	SC4	SC4
							< 0.2	≥ 0.2 to < 0.35	≥ 0.35 to ≤ 0.75	> 0.75	> 0.3

SI: 25.4 mm = 1 in, 1 kN/m = 737.6 lb/ft

1. OX-IS and SI-Strong Structural Insulation attached with a minimum 16-gauge, 25 mm crown staples shall penetrate a minimum of 25 mm (1") into the stud. Fasteners are to be installed with the crown parallel to the framing and spaced a maximum of 76 mm (3") o.c. at the panel edges and 76 mm (3") o.c. in the field. Fastener edge distance shall be a minimum of 9.5 mm (3/8"). Fastener head shall be in contact with the panel surface. Alternatively, fastener heads are permitted to be overdriven into foam portion of the panel with no reduction in shear capacities.
2. Walls installed with minimum 12.7 mm (1/2") Gypsum wallboard attached with minimum #6 type W or S screws 32 mm (1 1/4") long. Fasteners shall maintain a minimum edge distance of 9.5 mm (3/8").
3. All seismic design parameters follow the equivalency as defined in **Section 3** of this report.
4. Response modification coefficient, R_d, for use throughout NBC.
5. For combinations of different types of SFRS acting in the same direction in the same story, $R_d R_o$ shall be taken as the lowest value of $R_d R_o$ corresponding to these systems.
   See NBC Division B, Article 4.1.8.9.
6. Consider the additional system restrictions in Article 4.1.8.10 of NBC Division B.
7. Heights are maximum height limits above grade, as defined in NBC Division B Table 4.1.8.9.
8. NL = Not Limited
9. NBC Table 9.23.13.6 requires 15.9 mm (5/8") thick gypsum with framing 610 mm (24") o.c.

Table 3. Uplift Performance of OX-IS and SI-Strong Structural Insulation

Structural Sheathing Product	Specified Uplift Resistance kN/m (lb/ft)[2]	Maximum Stud Spacing mm (in)	Fastener Schedule
1/2" OX-IS or 1/2" SI-Strong: Single Top Plate	4.5 (310)	406 (16) o.c.	25-mm (1") crown, 32 mm (1 1/4") leg 16-gauge galvanized staples or 3 mm (0.120") x 32 mm (1 1/4") roofing nails, 76 mm (3") o.c. to perimeter/field[1]
0.92" OX-IS R5: Single Top Plate	5.6 (385)		
1" OX-IS or 1" SI-Strong: Single Top Plate	5.6 (385)		
1" OX-IS or 1" SI-Strong: Double Top Plate	11.0 (760)		

SI: 25.4 mm = 1 in, 1 kN/m = 737.6 lb/ft

1. Staple crowns to be installed parallel to grain.
2. The resistances shown are for the purpose of providing information on the hold-down resistance of the sheathing-to-top-plate connection independent of lateral loading. Where combined shear and uplift loading is needed, consult a professional engineer.

Table 4. Transverse Load Performance of OX-IS and SI-Strong Structural Insulation[1]

Structural Sheathing Product	Transverse Wind Load Resistance	
	Maximum Stud Spacing, mm (in)	Hourly 1-in-50 Wind Pressure,[2] kPa
OX-IS and SI-Strong Structural Insulation	610 (24) o.c.	6.5

SI: 25.4 mm = 1 in, 1 MPa = 145 psi

1. Fastener Schedule: 11 mm (7/16") crown, 32 mm (1 1/4") leg, 16-gauge galvanized staples, 76 mm (3") o.c. at the perimeter, 152 mm (6") o.c. in the field. Staple crowns to be installed parallel to grain.
2. Hourly Wind Pressure (1-in-50) for selected locations can be located in NBC Division B Appendix C Table C-2.

5.2.3 *Steel-Framed Construction:*

Table 5. Specified Shear Strength for OX-IS and SI-Strong Structural Insulation on 20-gauge 50 ksi Metal Studs

Structural Sheathing Product	Maximum Fastener Spacing (edge/field) mm (in)	Max Stud Spacing, mm (in)[1]	GWB Thickness mm (in)[2,3]	GWB Fastener Spacing (edge/field)	Specified Shear Strength kN/m (plf)	Structural Sheathing Fastener Schedule
1/2" OX-IS, 1/2" SI-Strong, 1/2" OX-IS HS	76/76 (3/3)	610 (24)	No GWB	-	4.7 (320)	Table Note 4
			12.7 (1/2) GWB	8/8	7.0 (480)	Table Note 4
0.92" OX-IS R5	76/76 (3/3)		No GWB	-	5.5 (375)	Table Note 5
					3.3 (225)	Table Note 6
					9.2 (630)	Table Note 4
	76/305 (3/12)		No GWB	-	9.2 (630)	Table Note 5
	152/305 (6/12)		No GWB	-	4.6 (310)	Table Note 6
	305/305 (12/12)		No GWB	-	2.5 (170)	Table Note 7
	76/76 (3/3)		12.7 (1/2) GWB	203/203 (8/8)	6.5 (450)	Table Note 7
				203/305 (8/12)	6.8 (465)	Table Note 7
				152/305 (6/12)	7.6 (520)	Table Note 7
1" OX-IS, 1" SI-Strong, 1 5/8" OX-IS, 1 5/8" SI-Strong	76/76 (3/3)		No GWB	-	5.5 (375)	Table Note 5
					3.3 (225)	Table Note 6
					9.2 (630)	Table Note 4
	76/305 (3/12)		No GWB	-	9.2 (630)	Table Note 5
	152/305 (6/12)		No GWB	-	4.6 (310)	Table Note 6
	305/305 (12/12)		No GWB	-	2.5 (170)	Table Note 7
	76/76 (3/3)		12.7 (1/2) GWB	203/203 (8/8)	6.5 (450)	Table Note 7
				203/305 (8/12)	6.8 (465)	Table Note 7
				152/305 (6/12)	7.6 (520)	Table Note 7

Structural Sheathing Product	Maximum Fastener Spacing (edge/field) mm (in)	Max Stud Spacing, mm (in)[1]	GWB Thickness mm (in)[2,3]	GWB Fastener Spacing (edge/field)	Specified Shear Strength kN/m (plf)	Structural Sheathing Fastener Schedule

SI: 25.4 mm = 1 in, 1 kN/m = 737.6 lb/ft

1. Steel studs shall be minimum 20-gauge 50ksi steel studs spaced at 24" o.c.
2. Gypsum attached with a minimum #6 type S screws 1 1/4" long with a minimum edge distance of 9.5 mm (3/8").
3. Where gypsum wallboard is not installed on the interior face of the wall, the wall shall be constructed with mid-height horizontal bracing installed every other cavity space.
4. #8 x 1 self-drilling screws with modified truss head, driven flush with exterior of foam board
5. #8 x 2 self-drilling screws with modified truss head, driven flush with exterior of foam board
6. 0.100' diameter x 1 1/2" long pins
7. #8 x 2 self-drilling screws with modified truss head, driven through foam plastic to seat against the backer material

5.3 *Water-Resistive Barrier (WRB)*

5.3.1 OX-IS and SI-Strong Structural Insulation may be used as a WRB as prescribed in NBC Division B Note A-5.6.2.1 when installed on exterior walls as described in this section.

5.3.2 OX-IS and SI-Strong Structural Insulation shall be installed with board joints placed directly over exterior framing spaced a maximum of 610 mm (24") o.c. The fasteners used to attach the board shall be installed in accordance with **Table 2**, **Table 3**, **Table 4** and **Section 6** as applicable.

5.3.3 All seams and joints between boards shall be sealed with an approved construction tape in accordance with **Section 6**. Approved construction tape includes 73 mm (2 7/8") OX SeamTape®. Flashing tape may be required for effective taping of inside and outside corners.

5.3.4 A separate WRB may also be provided. If a separate WRB method is used, overlapping or taping of the sheathing joints is not required.

5.3.5 Flashing of penetrations shall comply with the applicable code and must be installed at all sheathing penetrations. Use qualified flashing tape, such as Arctic-Flash® Synthetic Flashing, HomeGuard® Flexible Butyl Flashing, or HomeGuard® RA-plus® Flashing. See **Figure 4**, **Figure 5**, and **Figure 6** for typical penetration flashing details.

5.3.6 Flashing Details – Typical Flanged and Unflanged Penetrations and Window

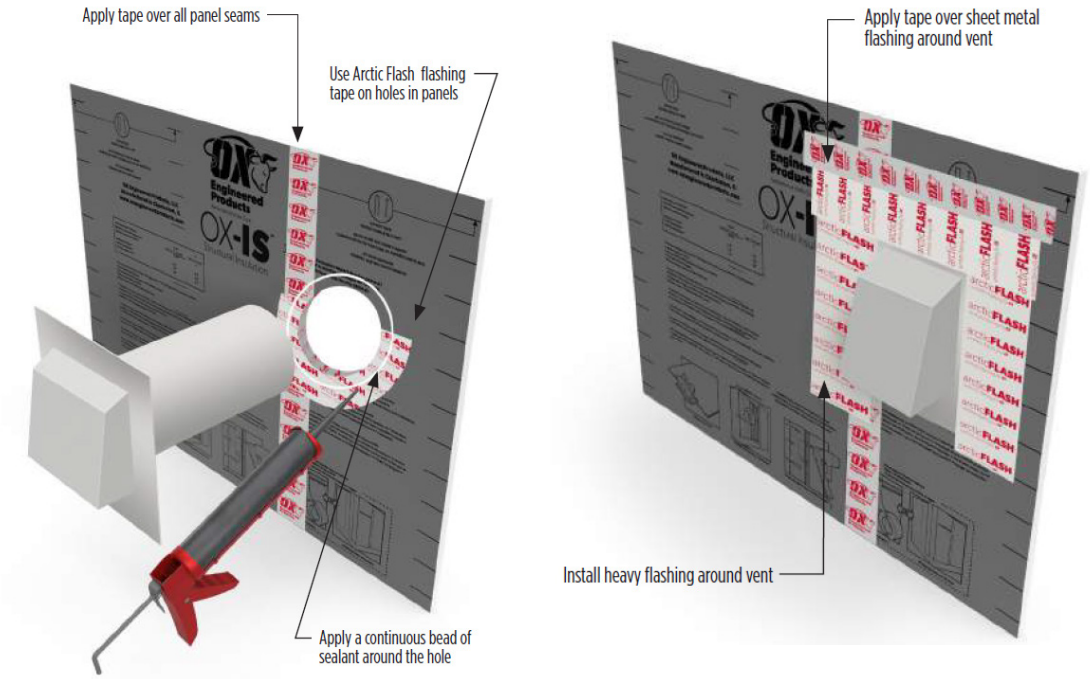


Figure 4. Typical Penetration Flashing Detail – Flanged

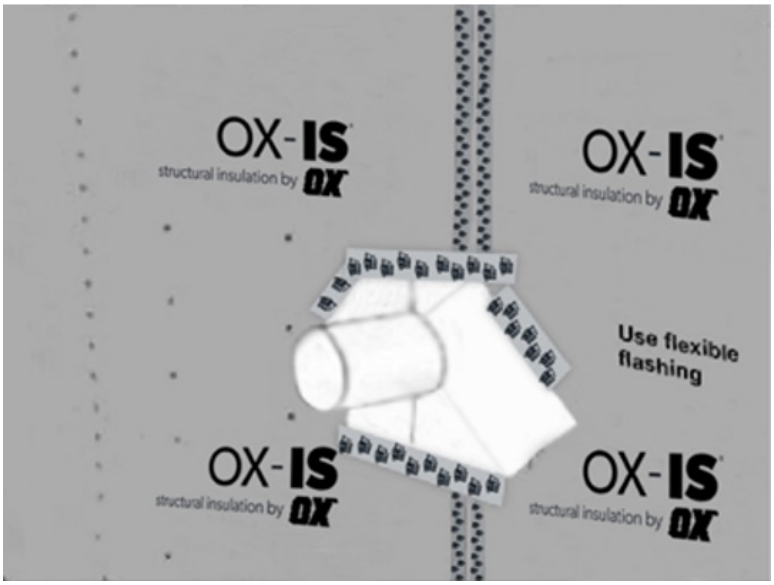


Figure 5. Typical Penetration Flashing Detail – Unflanged

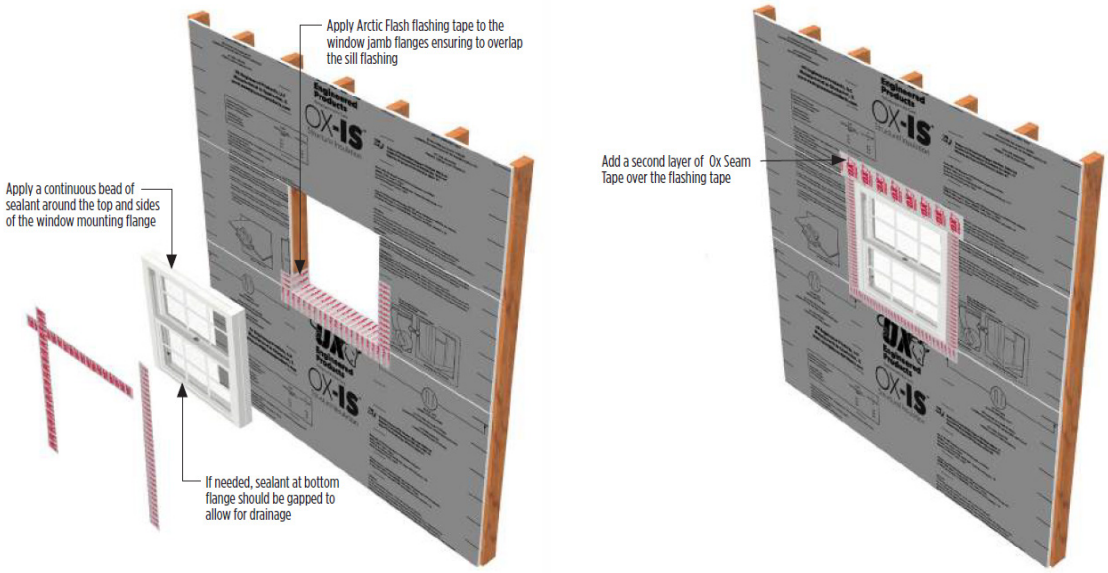


Figure 6. Typical Window Flashing Detail

5.4 *Thermal Resistance (RSI-Values and R-Values)*

5.4.1 OX-IS and SI-Strong Structural Insulation meet the continuous insulated sheathing requirements complying with the provisions of NECB Division B Part 3.

5.4.2 OX-IS and SI-Strong Structural Insulation have the thermal resistances shown in **Table 6**.

Table 6. OX-IS and SI-Strong Structural Insulation Thermal Resistance Properties

Thickness	RSI (R-Value), $m^2 \cdot K/W$ ($hr \cdot ft^2 \cdot °F/Btu$)
1/2" OX-IS, OX-IS R5, or SI-Strong	0.53 (3.0)
3/4" OX-IS, OX-IS R5, or SI-Strong	0.70 (4.0)
0.92" OX-IS R5	0.88 (5.0)
1" OX-IS or SI-Strong	1.06 (6.0)
1 1/2" OX-IS or SI-Strong	1.58 (9.0)
SI: 25.4 mm = 1 in, 1 m2·K/W = 5.678 hr·ft²·°F/Btu	

5.5 *Air Barrier*

5.5.1 OX-IS and SI-Strong Structural Insulation meet the requirements of NECB Division B Part 3 for use as a component of the air barrier when installed in accordance with the manufacturer installation instructions and this report, with all seams, including the top and bottom edges, taped (**Table 7**).

Table 7. OX-IS and SI-Strong Structural Insulation Air Barrier Material Properties

Products	Air Permeance[1,2]
OX-IS and SI-Strong Structural Insulation	< 0.02 ($L/s \cdot m^2$)
1. Tested in accordance with ASTM E2178. 2. When tested at a pressure differential of 75 Pa.	

5.6 *Thermal Barrier Requirements - Attic, Crawlspace, or Other Uninhabitable Space Applications*

5.6.1 Installation shall be fully protected from the interior of the building by an approved 15-minute thermal barrier or ignition barrier as required by NBC Division B Article 9.10.17.10.

5.7 *Fire Safety Performance*

5.7.1 *Surface Burning Characteristics:*

5.7.1.1 OX-IS and SI-Strong Structural Insulation have the surface burning characteristics, as presented in **Table 8**, when tested in accordance with CAN/ULC-S102 per NBC Division B Subsection 3.1.12 and Article 9.10.3.2.

Table 8. Surface Burn Characteristics of OX-IS and SI-Strong Structural Insulation

Products	Flame Spread Value	Smoke Developed Value
OX-IS and SI-Strong Structural Insulation[1]	60	35
1. Foam portion only tested in accordance with CAN/ULC-S102, with maximum foam thickness of 2".		

5.8 *Non-Structural Applications*

5.8.1 Where other means of wall bracing are provided or are not required, and an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing, OX-IS and SI-Strong Structural Insulation may be installed in accordance with **Section 6**.

5.9 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science and fire science.

6 Installation

6.1 Installation shall comply with the manufacturer installation instructions, this report, the approved construction documents and the applicable building code.

6.2 In the event of a conflict between the manufacturer installation instructions this report and the applicable building code, the more restrictive shall govern.

6.3 *Installation Procedure*

6.3.1 *General:*

6.3.1.1 Fasteners shall be installed with a nominal edge distance of 9.5 mm (3/8") for gypsum.

6.3.1.2 Where used, always fasten staples with the crown parallel to the framing member.

6.3.1.3 Where hold-down straps are used, install structural sheathing first, remove foam at strap location, then install the strap over the face of the structural sheathing backer and attach per the manufacturer installation instructions.

6.3.2 *Orientation:*

6.3.2.1 OX-IS and SI-Strong Structural Insulation may be installed vertically or horizontally over studs, with framing that has a thickness of not less than 38 mm (1 1/2") and spaced a maximum of 610 mm (24") o.c.

6.3.2.2 Sheathing joints must be butted at framing members, and all panel edges must be blocked. A single row of fasteners must be applied to each panel edge into the stud or blocking below. Each panel must be completely fastened once fastening begins, not simply tacked.

6.3.3 *Attachment:*

6.3.3.1 *OX-IS and SI-Strong Structural Insulation:*

6.3.3.1.1 Minimum 25-mm (1") crown by 32-mm (1 1/4") leg, 16-gauge staples with a 25 mm (1") minimum embedment into the stud unless otherwise stated in **Section 5**.

6.3.3.1.2 Fastener spacing shall be a maximum of 76 mm (3") o.c. along the edge and 76 mm (3") o.c. in the field unless otherwise permitted in **Section 5**.

6.3.3.2 *Gypsum Wallboard:*

6.3.3.2.1 For NBC Division B Part 9 applications, gypsum nail fasteners shall be spaced a maximum of 152 mm (6") o.c. on vertical wall supports and 305 mm (12") o.c. along intermediate supports.

6.3.3.2.2 For NBC Division B Part 9 applications, gypsum screw fasteners shall be spaced a maximum of 152 mm (6") o.c. on vertical wall supports and 305 mm (12") o.c. along intermediate supports.

6.3.3.2.3 Where required, gypsum wallboard shall be a minimum 12.7 mm (1/2") thickness and shall be attached with #6 x 32 mm (1 1/4") Type W or S screws, diameter 3.3 mm (0.13") spaced as shown in **Section 5**.

6.3.4 *Treatment of Joints:*

6.3.4.1 OX-IS and SI-Strong Structural Insulation sheathing joints must be butted at framing members and a single row of fasteners must be applied to each panel edge into the stud below, with the staple crowns parallel to framing.

6.3.5 *Window Treatments:*

6.3.5.1 OX-IS and SI-Strong Structural Insulation must be installed with appropriate flashing and counter flashing in conformance with accepted building standards and in compliance with local building codes and the flashing manufacturer installation instructions.

6.3.6 *Non-Structural Applications:*

6.3.6.1 Install panels with nails that have a minimum shank diameter of 2.9 mm (0.113") and a 25 mm (1") minimum stud embedment or 16-gauge 11 mm ($^{7}/_{16}$") crown staples and a 25 mm (1") minimum stud embedment.

6.3.6.2 The fastener spacing shall be 152 mm (6") o.c. along the top, bottom, and vertical panel edges and 305 mm (12") o.c. in the field. Each panel shall be completely fastened once fastening begins, not simply tacked.

7 Substantiating Data

7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

7.1.1 Lateral load testing and data for determining comparative equivalency for use as an alternative material, in accordance with ASTM E72, ASTM E564, and ASTM E2126

7.1.2 Transverse load testing in accordance with ASTM E330

7.1.3 Test reports and data for determining use as a WRB material, in accordance with ASTM E331

7.1.4 Test reports and data for determining use as a component of an air barrier, in accordance with ASTM E2178

7.1.5 Test reports and data for determining surface burning characteristics in accordance with CAN/ULC S102

7.1.6 Test reports and data for determining comparative equivalency for use as an alternative material in accordance with NBC Division A Section 1.2

7.2 Manufacturer installation recommendations for structural sheathing on exterior walls.

7.3 Information contained herein is the result of testing and/or data analysis by sources that conform to the evaluation requirements of NBC Volume 1 Relationship of the NBC to Standards Development and Conformity Assessment and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

7.4 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through provincial, territorial, or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes a product as being equivalent to that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

7.5 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, Listings, certified reports, duly authenticated reports from approved agencies, and research reports prepared by approved agencies and/or approved sources provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this report, may be dependent upon published design properties by others.

7.6 Testing and engineering analysis: The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.

7.7 Where additional condition of use and/or code compliance information is required, please search for OX-IS and SI-Strong Structural Insulation on the DrJ Certification website.

8 Findings

8.1 As delineated in **Section 3**, OX-IS and SI-Strong Structural Insulation have performance characteristics that were tested and/or meet pertinent standards and is suitable for use pursuant to its specified purpose.

8.2 When used and installed in accordance with this report and the manufacturer installation instructions, OX-IS and SI-Strong Structural Insulation shall be approved for the following applications:

8.2.1 Lateral (in-plane) load resistance due to wind and seismic loads carried by shear walls and braced wall bands.

8.2.2 Resistance to uplift loads in single and double-top-plate applications.

8.2.3 Transverse (perpendicular-to-plane) load resistance due to components and cladding pressures on building surfaces.

8.2.4 Performance of the foamed-plastic component for conformance to NBC Division B Article 3.1.5.15.

8.2.5 Performance for use as foamed-plastic insulating sheathing in accordance with NBC Division B Article 9.36.2.55 and NECB Division B Article 3.2.1.2.

8.2.6 Performance for use as a WRB in accordance with NBC Division B Note A-5.6.2.1.

8.2.7 Performance for use as an air barrier in accordance with NBC Division B Section 5.4 and Subsection 9.25.3, and NECB Division B Subsection 3.2.4.

8.2.8 Surface burning characteristics in accordance with NBC Division B Subsection 3.1.12 and Article 9.10.3.2.

8.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from OX Engineered Products, LLC.

8.4 These innovative products have been evaluated in the context of the codes listed in **Section 2** and are compliant with all known provincial, territorial, and local building codes. Where there are known variations in provincial, territorial, or local codes applicable to this report, they are listed here.

8.4.1 No known variations

8.5 NBC Volume 1 Relationship of the NBC to Standards Development and Conformity Assessment:

> **Certification**
> Certification is the confirmation by an independent organization that a product, service, or system meets a requirement…Certification bodies publish lists of certified products and companies…Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services.
>
> **Evaluation**
> An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of the Code requirement...

8.6 ISO/IEC 17065 accredited third-party certification bodies,[5] including but not limited to, Standards Council of Canada (SCC)[6] and ANSI National Accreditation Board (ANAB),[7] confirm that product certification bodies have the expertise to provide technical evaluation services within their scope of accreditation. All SCC and ANAB product certification bodies meet NBC requirements to offer evaluation services for alternative solutions.[8]

8.6.1 DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131[9] and employs professional engineers.[10]

8.7 Through ANAB accreditation and the IAF Multilateral Agreements, this report can be used to obtain product approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*." IAF specifically says, "*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope*."[11]

8.8 Product certification organizations, accredited by the SCC and ANAB, are defined as equivalent evaluation services:

8.8.1 Canada-United States-Mexico Agreement (CUSMA), Article 11.6 Conformity Assessment confirms mutual recognition by stating, "*...each Party shall accord to conformity assessment bodies located in the territory of another Party treatment no less favorable than that it accords to conformity assessment bodies located in its own territory or in the territory of the other Party*."

8.8.2 The SCC National Conformity Assessment Principles states, "*SCC is a member of a number of international organizations developing voluntary conformity assessment agreements that help ensure the international acceptance of Canadian conformity assessment results. Signatories to these agreements (like SCC) recognize each other's accreditations as being equivalent to their own*."[12]

8.9 Building official approval of a licensed professional engineer is performed by verifying the professional engineer and/or their business entity are listed by the engineering regulators of the relevant jurisdiction.

9 Conditions of Use

9.1 Material properties shall not fall outside the boundaries defined in **Section 3**.

9.2 As defined in **Section 3**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

9.3 This report and the installation instructions shall be available to the jurisdiction in which the project is to be constructed.

9.4 As listed herein, OX-IS and SI-Strong Structural Insulation shall not be used:

9.4.1 To resist horizontal loads from concrete and masonry walls; nor

9.4.2 As a nailing base.

9.5 OX-IS and SI-Strong Structural Insulation shall be fully protected from the interior of the building by an approved 15-minute thermal barrier.

9.6 In areas where termites are known to occur, and foundations are insulated or otherwise finished in a manner that could conceal a termite infestation in accordance with NBC Division B Article 9.3.2.9, a metal or plastic barrier shall be installed through the insulation to control the passage of termites behind or through the insulation.

9.7 Specified shear strengths shall not exceed values in **Table 1** for wind loads and **Table 2** for seismic loads.

9.8 Specified uplift loads shall not exceed values in **Table 3**.

9.9 Transverse design loads shall not exceed those described in **Table 4**, unless an approved exterior wall covering capable of separately resisting loads perpendicular to the face of the walls is installed over the sheathing.

9.10 OX-IS and SI-Strong Structural Insulation are manufactured under a quality control program with quality control inspections established by the governing legislation of the adopting province or territory, as described in the NBC Volume 1 commentary on Conformity Assessment.

9.11 When installed as a wall sheathing, but not installed per structural requirements, light-framed walls shall be braced by other means.

9.12 When used as a WRB, installation shall be in accordance with **Section 5.3**.

9.13 Where required by regulation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:

9.13.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice, and, when prepared by an approved source, shall be approved when signed and sealed.

9.13.2 This report and the installation instructions shall be submitted at the time of permit application.

9.13.3 These innovative products have an internal quality control program and a third-party quality assurance program.

9.13.4 At a minimum, these innovative products shall be installed per **Section 6** of this report.

9.13.5 This report shall be reviewed for code compliance by the AHJ in concert with the duties and powers granted to the building official by the provincial regulations governing such duties and powers.

9.13.6 The application of these innovative products in the context of this report are dependent on the accuracy of the construction documents, implementation of installation instructions, inspections, and any other regulatory requirements that may apply.

9.14 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the designer (i.e., owner).

9.15 The actual design, suitability, and use of this report, for any particular building, is the responsibility of the owner or the authorized agent of the owner.

10 Identification

10.1 The innovative products listed in **Section 1.1** are identified by a label on the board or packaging material bearing the manufacturer name, product name, report number, and other information to confirm code compliance.

10.2 Additional technical information can be found at www.oxengineeredproducts.com.

11 Review Schedule

11.1 This report is subject to periodic review and revision. For the most recent version, visit drjcertification.org.

11.2 For information on the status of this report, contact DrJ Certification.

12 Legislation that Authorizes New Product Approval in International Markets is Found in Appendix A

12.1 OX-IS and SI-Strong Structural Insulation has been tested by an ISO/IEC 17025 accredited laboratory and/or evaluated to be in conformance with accepted engineering practice to ensure durable, livable and safe construction.

12.2 This report is published by an ISO/IEC 17065 accredited certification body with the expertise to evaluate products, materials, designs, services, assemblies and/or methods of construction.

12.3 This report meets the legislative intent and definition of a duly authenticated report, which shall be accepted by the AHJ, unless there are specific reasons why the alternative shall not be approved as provided for in writing.

Appendix A

1 Legislation that Authorizes New Product Approval in Canada

1.1 The Competition Act is a Canadian federal law governing competition law in Canada. The Act contains both criminal and civil provisions aimed at preventing anti-competitive practices in the marketplace. The Act is enforced and administered by the Competition Bureau, whose regulations encourage the approval of NBC referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:

1.1.1 Advance Innovation,

1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and

1.1.3 Benefit consumers through lower prices, better quality, and greater choice.

1.2 **Approved by International Jurisdictions**: The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade (TBT) agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements proclaim the desire of both countries to have their markets open to innovation.

1.3 These agreements:

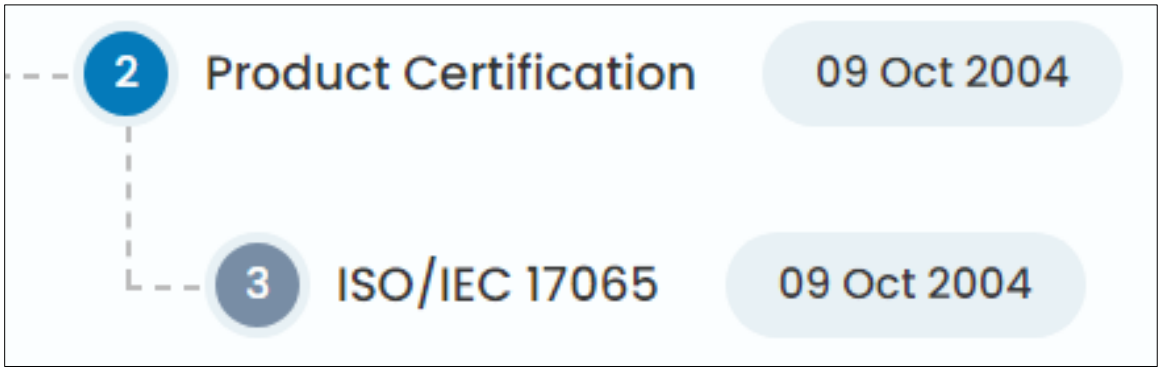
1.3.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,

1.3.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.

1.3.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

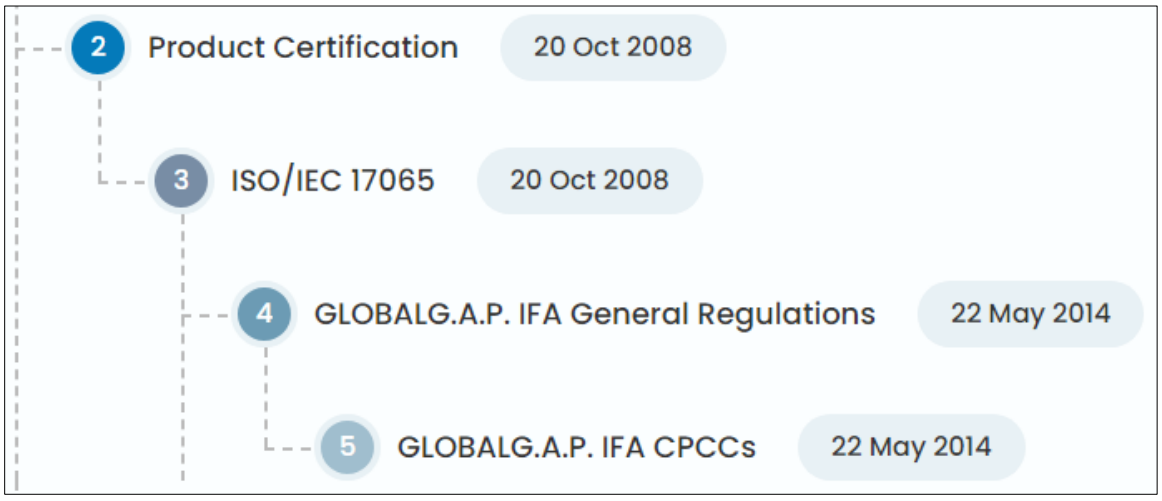
1.4 To this end, Canada operates an accreditation system as follows:

1.5 This includes ISO/IEC 17065 product certification as follows:

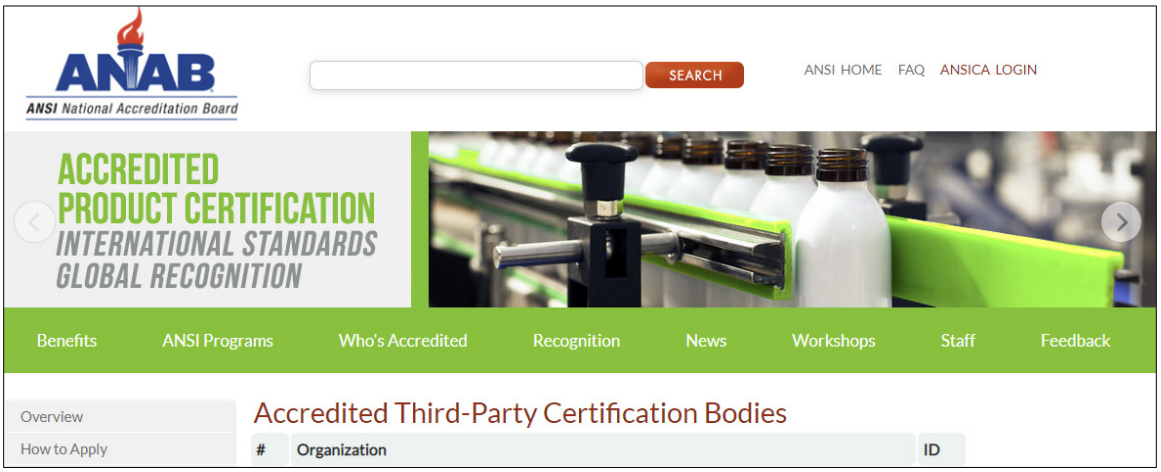


1.6 Similarly, the United States operates multiple accreditation processes with ANAB being the most prominent ISO/IEC 17065 product certification organization as follows:

1.7 This includes ISO/IEC 17065 product certification as follows:



1.8 The list of ANAB accredited ISO/IEC 17065 product certification organizations can be found at the following link: https://anabpd.ansi.org/Accreditation/product-certification/DirectoryListingAccredited?menuID=1&prgID=1



1.9 Approval is granted via International Agreement, where the purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories. Subsequent acceptance of accredited certification and validation/verification statements is required so that one accreditation can be used for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.

1.10 Consequently, and as one example, these agreements permit product approval of innovative Australian and New Zealand products into US markets and vice-versa.

1.11 Finally, questions that often arises are, *"Why do these agreements exist?"* and *"Why is the ISO/IEC 17065 accredited third-party certification process so important?"*

1.11.1 The answer is that all countries desire to protect the intellectual property and trade secrets of their country's businesses.

1.11.2 In the US this protection is provided by 18 U.S. Code § 1831 Under Economic Espionage, where it states *"whoever, intending or knowing that the offense will benefit any foreign government, foreign instrumentality, or foreign agent, knowingly steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains a trade secret shall be fined not more than $5,000,000 or imprisoned not more than 15 years, or both."*

1.11.3 Any organization that commits any offense described shall be fined not more than the greater of $10,000,000 or three (3) times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided.[13]

1.11.4 Protection of intellectual property and trade secrets reinforces the value of the IAF MLA, the GATT/TBT and the ISO/IEC 17065 product approval process.

1.11.5 The goal is to protect everyone's best interests while also facilitating economic freedom and opportunity by promoting free and fair competition in the marketplace.

Notes

[1] For more information, visit drjcertification.org or call us at 608-310-6748.

[2] Unless otherwise noted, all references in this report are from the 2020 version of the NBC. This alternative solution is also approved for use with the 2010 and 2015 NBC and the standards referenced therein.

[3] 18 U.S. Code § 1831 - Economic espionage - Whoever, intending or knowing that the offense will benefit any foreign government, foreign instrumentality, or foreign agent, knowingly steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains a trade secret shall be fined not more than $5,000,000 or imprisoned not more than 15 years, or both. Any organization that commits any offense described shall be fined not more than the greater of $10,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90.

[4] ANAB is part of the USMCA and IAF MLA, where the purpose of these agreements are to ensure mutual recognition of accredited certification and validation/verification statements between agreement signatories, and subsequent acceptance of ANAB accredited certification and validation/verification statements by professional engineers based upon having one universal approval process for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction.

[5] https://anabpd.ansi.org/Accreditation/product-certification/DirectoryListingAccredited?menuID=1&prgID=1

[6] https://iaf.nu/en/member-details/?member_id=91

[7] https://iaf.nu/en/member-details/?member_id=14

[8] NBC Division A Clause A-1.2.1.1.(1)(b) provides information on code compliance via alternative solutions and defines alternative solutions as "...achiev[ing] at least the minimum level of performance required by Division B." NBC Division C Section 2.3 includes additional guidance for documentation of alternative solutions.

[9] https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?&prgID=1&OrgId=2125&statusID=4

[10] Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain material, product, design, or method of construction approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*".

[11] https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise

[12] The National Conformity Assessment Principles states, "*Product regulations and standards may vary from country to country. If these are set arbitrarily, they could be deemed as protectionist. The World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT Agreement) is intended to ensure that technical regulations, standards and conformity assessment procedures of member countries do not create unnecessary obstacles to trade. Under the TBT Agreement, members of the WTO agree to use international standards, including conformity assessment standards and guides, as a basis for their technical requirements.*"

[13] https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90